DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

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GENERAL NOTE.

Owing to the current nature of the investigations mentioned in the Technical News Bulletin, sometimes it will be impossible to supply printed information regarding them. However, in these cases, when the investigation has progressed sufficiently far, the Bureau will be pleased to furnish technical data to those engaged in the particular application of the subject, in order to avoid the delay incident to publication.

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1 The Efficiency of Insulation used in Cold Storage Work

During the last few years there has been a great demand for information concerning the relative values of various materials that are used for insulation and this has led to extensive experimental investigations in different laboratories. While a great many factors, such as resistance to moisture, inflammability, strength, durability, etc., must be considered in choosing an insulating material, the material must of necessity be a good insulator and the measurement of its thermal conductivity is, therefore, the matter of most importance. The Bureau has developed and used for several years a very satisfactory apparatus for measuring thermal conductivity. The results obtained have been assembled and a standardized form of the apparatus suitable for general use has been designed. The American Society of Refrigerating Engineers has taken an active interest in this work, so that a standard apparatus may be available, the use of which will eliminate disputes due to differences resulting from the employment of unsuitable testing methods.

It may be said that the technical difficulties which led to such discrepancies have been largely overcome but a considerable amount of

educational work is still necessary among the manufacturers and users of insulating materials in order to eliminate misunderstandings. The results of the Bureau's work will be published in a forthcoming number of the Journal of the American Society of Refrigerating Engineers and will also be issued as a Bureau of Standards Scientific paper.

2 The Conditions of Air Flow Through Radiators

An investigation is being conducted on the conditions of air flow through airplane cooling radiators among which are represented all the types tested by the Bureau. To date, studies have been made on 24 specimens of this series, and in addition special tests have been conducted on a number of radiators submitted by the Air Service. One of the military departments recently submitted a problem in connection with the direct air cooling of internal combustion engine cylinders and information of considerable value has been obtained as a result of this work. Progress has also been made in determining the temperature distribution in the air cells of certain typical cooling radiators. A comprehensive technical paper covering the general problem of aircraft engine cooling is in preparation.

3 The Heat Treatment of High Chromium Steel

The experimental work in this investigation has been completed and a preliminary report covering the changes in tensile properties, hardness, and microstructure under varying thermal treatments has been submitted to the Journal of the Society of Automotive Engineers, and to Chemical and Metallurgical Engineering for publication. A summary of the results obtained is as follows:

Samples of high chromium steel of the following analysis C .29%, Mn .38%, Si .70%, Cr 13.2% quenched in oil from various temperatures show

(a) That hardness, as measured by Brinell and Shore instruments, increases with increasing quenching temperature until a temperature of about 1066°C (1950°F) is reached. Maximum range of hardness is generally obtained by quenching from this temperature, up to the highest heat used, but in some cases this hardness actually decreases, due to retention of the solid solution.

(b) That quenching from about 955°C (1750°F) develops the best combination of strength and ductility which is not coincident with range of maximum hardness. Quenching from this or

lower temperatures does not retain all the carbide in solution, as is the case in samples quenched from considerably higher temperatures, notably 1140° to 1232°C (2100° and 2250°F).

(c) That ductility as measured by elongation and reduction is very low in those samples quenched from 1010°C (1850°F) or above.

Short-time tempering at temperatures up to about 427°C (800°F) of samples previously quenched from both 955° and 1149°C (1750°and 2100°F) decreases brittleness. However, ductility is increased to a greater extent in those samples quenched from 955°C (1750°F) than those quenched from the higher temperatures. Tempering above about 427°C (800°F) markedly decreases strength values and hardness, which is, of course, accompanied by greatly increased ductility. In general, the structure of the hardened steel tends to persist even when tempered for a short period of time at temperatures comparatively close to the lower critical range, the characteristics depending upon the quenching temperature used. The most rapid change in tensile properties and hardness occurs in tempering between about 427°and 538°C (800° and 1000° F).

4 Tensile Properties of Boiler Plate at Elevated Temperatures

A quantitu of boiler plate has been rolled at a blue heat (300°C) preparatory to determining the properties at elevated temperatures and also the effect of blue work on the tensile properties at normal temperatures. The effect of low temperatures annealing on plates worked below the thermal critical range will next be determined. Special apparatus has also been constructed for the determination of the effect of rate of loading on the elastic limit at elevated temperatures. This necessitates the use of a motion picture camera for obtaining records of constantly moving dials and constantly increasing loads. Trial runs have been made and several desired modifications have already been installed. When finished, this investigation will yield more complete data than are now available concerning the effects of various thermal and mechanical treatments, below the thermal critical ranges, on the tensile properties of low carbon steel at temperatures up to about 470°C.

5 Fish Scaling on Sheet Steel Enamels

The part of this investigation relating to the effect of the shape of the metal vessel on fish scaling has been completed. It has been found that certain portions of the miniature basins used for

test, fish-scaled consistently on the convex parts of the specimens. Again, flat plates fish scale more than basins which are free to expand and contract. The thermal expansion of the metals used in this work and of rods made from various enamels is being determined. From the work done so far, it appears that the enamels show a critical contraction at ~~of~~ about 450° to 500°C.

6 Recent Chemical Publications

Recent chemical work of the Bureau is described in the following publications and articles which have appeared in the scientific press:

Technologic Paper No. 162 - The Extration of Rubber Goods. The following are the conclusions abstracted from this paper:

The extraction for 8 hours with acetone followed by 4 hours' extraction with chloroform does not remove all soluble material from some rubber compounds. After a rubber sample has been extracted with acetone, it was found (a) that chloroform in every case extracted slightly more material than carbon bisulphide, and (b) that constant boiling mixtures, such as 55% carbon bisulphide and 45% acetone, 68% chloroform and 32% acetone, extracted from many cheap compounds considerably more material than either chloroform or carbon bisulphide. The constant boiling mixture of 68% chloroform and 32% acetone exhibits a marked ability to dissolve vulcanized rubber as contrasted to the mixture of 55% carbon bisulphide and 45% acetone which hardly exhibits this ability at all. It is recommended that the constant boiling mixture of 55% carbon bisulphide and 45% acetone be used in place of acetone and chloroform to extract rubber samples for the following reasons:

(a) it eliminates one extraction together with the necessary weighings; (b) extraction is complete in 8 hours, while the acetone and chloroform extractions require a total of 12 hours; (c) the extraction of free sulphur is complete; (d) a rubber analysis in which the mixed solvent is used is more accurate than that in which acetone and chloroform are used separately, because little or no rubber is dissolved by this mixture as compared with chloroform which will in some cases dissolve considerable quantities, and the extraction of cheap rubber compounds is more complete, since the extracts obtained are greater than the sum of the acetone and chloroform extracts.

Article on a New Method for the Determination of Sulphur in Oils, in the Journal of Industrial and Engineering Chemistry, Volume 12, page 402, 1920.

In this paper the desirability of investigating the possible effect of sulphur compounds on the properties of lubricating oils is pointed out. The disadvantages of the methods now in general use for the determination of sulphur are indicated and a new procedure, which gives results at least as accurate as those by the bomb calorimeter, is described.

Besides the two above abstracted papers, 3 Bureau of Standards Circulars have recently been issued, as follows:

No. 91 - Recommended Specifications for Ochre, Dry and Paste;
No. 93 - Recommended Specifications for Iron Oxide and Hydroxide Paints; and
No. 94 - Recommended Specifications for Black Paint, Semi-paste and ready mixed.

7 Service Tests of Chrome Tanned and Oak Tanned Sole Leather

The Bureau has conducted a large number of tests on various kinds of sole leather to determine their relative wearing qualities. Recently the results of 28 service tests made to determine the comparative durability of chrome tanned and oak tanned sole leather were compared; the average result obtained showing that the chrome leather outwore the oak tanned by approximately 23% per unit thickness.

8 The Use of Wet and Dry Sand for Concrete

During the past month, several series of tests of concretes made from Potomac River sand and gravel have been carried out, using various proportions of cement to aggregate from 1:1½:3 to 1:3:6 and with the extremes of flowability used in practical concrete construction work. The results of these tests emphasize a feature of considerable importance to the contractor. When aggregates are proportioned by volume measure, as is customary on most construction work, it is found that the use of wet aggregates requires 1/2 to 1 bag more cement per cubic yard of concrete than do dry aggregates. Sand is generally wet or at least moist when used, so that the full difference may never be apparent in field practice, yet the use of sand from a pile which has just been exposed to rain will result in the employment of more cement for a given volume of concrete than would have been the case had the work been done on a dry day. The excess strength resulting from the increase in cement is unnecessary providing that designed strengths were obtained with the drier materials. As above mentioned, this increased

quantity of cement may be as high as one bag per cubic yard of concrete, and the increase in strength, due to the added cement in a cubic yard of concrete made with wet aggregates is roughly proportional to the increase in cement. Therefore, if there is a marked increase at any time in the moisture carried by the sand, the tendency on the job should be to use larger volumes of sand in the batch.

Marked improvement in the working qualities of the concrete will be noted under usual conditions when the relative volume of sand is increased and the gravel proportionally reduced. With well graded river sand and gravel, such as is available in the District of Columbia, the "oversanding" may be beneficial up to the point where the volume of sand in the batch is equal to the volume of the gravel. Such concrete will not segregate for maximum flowability commonly used in construction work; it will be easier working, the quantity of cement required per cubic yard will be slightly less and there will be no reduction in compressive strength.

9 Workability of Concrete in Alkali Soils and Waters

The investigation which the Bureau has resumed after a lapse of 3 years, due to the war, on the durability of concrete in alkali soils and waters, has been previously mentioned in this Bulletin. Tests made during the past year tend to confirm the conclusions, as previously stated in Technologic Paper No. 95; but final conclusions, as to the resistance of concrete to the action of various types of alkali waters cannot yet be drawn from the data now on hand. One interesting point, however, which has been definitely brought out by this work, is the marked variation in concentration of salts which may be found in the soil short distances apart. Tile placed in the highly concentrated portions or receiving seepage water direct from such areas may be exposed to concentration several times as great as similar tile which may happen to be placed further down the drain. The highest concentration of seepage water is not made apparent by analyzing the water collected at the outlet of the drain. Analyses of samples of soils and borings distributed over a tract of land previous to installing a drainage system may give a fairly good idea of the type of salts and the average concentration to which the tile later may be exposed, but there is no assurance that in small localized areas much higher concentration may not be found, or may not develop through a change in drainage conditions. As a type, sulphate waters appear to be most destructive to concrete, the severity of action seeming to vary with concentration of soluble

salts. The wide variation in quantities of the various constituents found indicates that action is not greatly dependent upon the presence or absence of any one constituent of water in which a large quantity of the sulphate is present.

10 Comparative Sieve Tests of Portland Cement

An interesting test has just been completed by the Bureau in cooperation with several other laboratories which indicates how closely the results of careful work along certain lines may be expected to check. A sample of cement was sent by the Atlas Portland Cement Company to the Bureau and to several other laboratories with a request for a 200 mesh sieve determination in order that the results as obtained by the different laboratories might be compared. The work was completed and the conclusions forwarded to the Atlas Company. It was found that all the results were in close agreement the extreme variation being only 0.3 of 1%.

11 Observations of Radio Transmission Phenomena by Amateur Radio Operators

It has been observed by radio amateurs generally that the strength of signals received from a given transmitting station varies rapidly during very short intervals of time, probably depending upon the weather and various meteorlogical conditions. The Bureau of Standards has desired to collect as much data as possible on the nature and causes of this fading of radio signals and with this object in view has secured the cooperation of the American Radio Relay League. In order to secure simultaneous observations of signals, arrangements have been made for a number of well-equipped amateur radio stations, including 6 transmitting stations and about 40 receiving stations to begin such a series of tests. The 6 transmitting stations will send out a broadcast message, each of which will last about 3 minutes, on Tuesday, Thursday, and Saturday evenings, beginning just after the time signals from the Arlington Naval Radio Station. The 6 above-mentioned stations will transmit for their different regions 10 minutes apart and 3 or 4 of them will be within the receiving range of each receiving station.

The Bureau of Standards has supplied forms on which the operators will record the strength of the signals they receive and other information, such as weather conditions, presence of strays or atmospheric disturbances, and the general character of radio transmission at the time of each observation, It is hoped that as a result of this program of careful observations some valuable conclusions regarding radio transmission will be reached. If the present plan,

which covers only the northeastern part of the United States, is successful, a more extensive program may be undertaken during the winter of 1920-1921.

12 Lecture Given at the Bureau of Standards Explaining the Phenomena of Radio Telegraphy and Telephony

Communication by means of electricity without wires has progressed very rapidly during the last few years, and has probably been given more consideration by the general public than almost any other scientific subject. It is, nevertheless, a fact that due to the somewhat inaccurate and misleading newspaper accounts which have appeared from time to time dealing with the principles of radio communication and which have been apt to surround the whole matter with an air of mystery, most people believe that the principles underlying wireless transmission are not very well known. On the contrary, radio communication is a natural effect following well-known causes. With the object of giving a concise and easily understood explanation of the principles underlying radio communication, a lecture was given at the Bureau of Standards during May of this year, in which the whole subject was thoroughly discussed in a way easily understood by all. The similarity between various forms of wave motion, of which radio communication is one, were described and illustrated. Copies of this lecture will be available for distribution to those interested.

13 The Transmission of Music by Radio

Music can be transmitted by wireless in the same manner as speech or code signals. As an incidental result of research work on radio telephony at the Bureau of Standards, it has been shown that music can be transmitted by radio without loss of quality. The possibilities in this direction are great and very interesting. By this means a concert given in one place may be available to those living at a distance. Experimental concerts are at present being sent out on Friday evening from 8:30 to 11, by the Radio Laboratory of the Bureau of Standards, using a wave length of 600 meters. One way of transmitting music has been to place a phonograph so that the sound from it will pass into the radio transmitter. The Bureau of Standards has made an interesting improvement upon this method, which consists of substituting the carbon microphone, which is the mouthpiece of an ordinary telephone, for the vibrating diaphragm ordinarily used on the phonograph. As a result, the phonograph sound record produces direct variations of electric current

in the telephone apparatus instead of producing sound, thus while no sound is heard where the phonograph record is being played, the music is easily heard by those at the distant receiving stations.

14 Work in Connection with Industrial Safety Codes

During the month, the final list of changes proposed for incorporation in the National Electrical Safety Code was sent out. As soon as comments from interested parties have been received, the new edition of this code will be sent to the printer and it will be available for distribution late in the summer. A similar stage has been reached in the case of the first edition of the National Safety Code for the Protection of the Head and Eyes of Industrial Workers. This code is being prepared in cooperation with an advisory committee of experts in this subject and final changes have been sent to the Committee for consideration. This code also is to be printed in the near future.

15 Determination of the Density of Invert Sugar

Last month's Bulletin mentioned the completion of an investigation on the composition and preparation of an invert sugar mixture of maximum solubility. During the computation of the experimental results in connection with this work, certain discrepancies were observed which suggested that the published densities of invert sugar solutions were inaccurate; consequently, these densities have been re-investigated. The Bureau has given data in Scientific Paper No. 375 on methods of inverting sugar by the use of very dilute hydrochloric acid. Inasmuch as sucrose cane sugar can be prepared in a state of very high purity, these data on methods of inversion afford a means for preparing invert sugar with great precision. For the determination of the density, it is merely necessary to apply a small correction for the excess of density caused by the hydrochloric acid. Invert sugar solutions were prepared by this acid-inverting method and also by the use of invertase, an inverting substance extracted from yeast. All the density determinations proved to be very consistent among themselves, and at considerable variance from the previously published data.

Respectfully,

S. W. STRATTON

Director
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